

## Claims

What is claimed is:

- [c1] A threaded tubular connection comprising:
  - a box member comprising an internal thread;
  - a pin member comprising a pin nose and an external thread engageable with the internal thread of the box member;
  - a protruding sealing surface disposed in the box member such that the pin member flexes radially inward upon passing the protruding sealing surface during make-up;
  - a recessed seal cavity disposed in the box member; and
  - a reverse angle shoulder at the pin nose that engages a reverse angle shoulder on the box member and forces the pin member to flex radially outward into the recessed seal cavity of the box member upon final make-up.
- [c2] The apparatus of claim 1, wherein the pin member flexes outward into the recessed seal cavity of the box member to a position beyond an initial free-state position.
- [c3] The apparatus of claim 2, wherein the pin member has a tapered sealing surface.
- [c4] The apparatus of claim 2, wherein the box member has a tapered sealing surface.
- [c5] The apparatus of claim 1, wherein the internal thread of the box member is a generally dovetail-shaped thread having stab flanks, load flanks, roots, crests, and increasing in width in one axial direction; and
  - the external thread of the pin member is a generally dovetail-shaped thread having stab flanks, load flanks, roots, crests, and increasing in width in the other axial direction so that the complementary roots and crests of the respective internal and external threads move into engagement during

make-up of the connection in conjunction with the movement of complementary stab and load flanks into engagement upon make-up of the connection.

- [c6] The apparatus of claim 1, wherein the internal thread of the box member is tapered and the external thread of the pin member is tapered.
- [c7] The apparatus of claim 1, wherein the internal thread of the box member is cylindrical and the external thread of the pin member is cylindrical.
- [c8] The apparatus of claim 1, wherein the internal thread of the box member and the external thread of the pin member comprise a single thread step.
- [c9] The apparatus of claim 1, wherein the internal thread of the box member and the external thread of the pin member comprise multiple thread steps.
- [c10] The apparatus of claim 1, wherein the recessed seal cavity allows for seal contact on both sides of the protruding sealing surface in the box member.
- [c11] The apparatus of claim 1, wherein the protruding sealing surface disposed in the box member comprises a drop in the inner diameter of the box followed by an increase in the inner diameter to a cylindrical surface and the recessed seal cavity.
- [c12] The apparatus of claim 1, wherein the protruding sealing surface disposed in the box member comprises a reducing taper in the inner diameter of the box followed by an increase in the inner diameter to a cylindrical surface and the recessed seal cavity.
- [c13] The apparatus of claim 1, wherein the protruding sealing surface disposed in the box member comprises a reducing taper in the inner diameter of the box followed by an increasing taper in the inner diameter to the recessed seal cavity.

- [c14] The apparatus of claim 1, wherein the reverse angle shoulders on the pin nose and box member have angles of less than 90°.
- [c15] The apparatus of claim 1, wherein the reverse angle shoulders on the pin nose and box member have angles of 40°.
- [c16] The apparatus of claim 1, wherein a secondary seal is formed between the pin nose and the recessed seal cavity.
- [c17] A method of forming a double flex seal for a tubular connection comprising:
  - engaging an internal thread of a pin member with an external thread of a box member;
  - flexing a pin nose of the pin member radially inward by passing the pin nose over a protruding sealing surface of the box member during make-up;
  - flexing the pin nose radially outward when a reverse angle shoulder of the pin nose comes into contact with a reverse angle shoulder of the box member during make-up; and
  - completing the double flex seal by finally making up the connection such that the pin nose of the pin member seats in a recessed seal cavity disposed in the box member.
- [c18] The method of claim 17, wherein the pin member flexes outward into the recessed seal cavity of the box member to a position beyond an initial free-state position.
- [c19] The method of claim 17, wherein the pin member has a tapered sealing surface.
- [c20] The method of claim 17, wherein the box member has a tapered sealing surface.
- [c21] A threaded tubular connection comprising:
  - a box member comprising an internal thread;

a pin member comprising an external thread engageable with the internal thread of the box member;  
means for flexing the pin member radially inward during make-up;  
means for engaging the pin member and the box member such that the pin member flexes radially outward upon final make-up; and  
means for forming a seal between the pin member and the box member.